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Abstract
The 2015 series of RIO Country Reports analyse and assess the policy and the national research and innovation system developments in relation to national policy priorities and the EU policy agenda with special focus on ERA and Innovation Union.

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Foreword

The report offers an analysis of the R&I system in Iceland for 2015, including relevant policies and funding, with particular focus on topics critical for EU policies. The report identifies the main challenges of the Icelandic research and innovation system and assesses the policy response. It was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites etc. The quantitative data is, whenever possible, comparable across all EU Member State and associated countries reports. Unless specifically referenced all data used in this report are based on Eurostat statistics available in February 2016.

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Executive summary

It is worth highlighting that Iceland has just over 330,000 inhabitants or around 0.06 % of the total EU population. The modest population and the small size of the Icelandic economy in general makes all comparison a challenging task, except when comparing on a per capita basis. This is important to keep in mind when providing an overview of the RDI landscape.

Under the auspices of the EEA Agreement, Iceland participates in the European Research Area (ERA) governance structures and participates in some of the EU's main research and Innovation programmes, including Horizon 2020, Erasmus+ and Creative Europe. In particular, Iceland has been active in research areas covering agriculture, renewable energy, health and marine-related issues.

The Science and Technology Policy Council (STPC) is the strategic body at the core of the R&D policy system in Iceland. The Ministry for Education, Science and Culture is the key ministry responsible for R&D policy implementation. The Icelandic Centre for Research (Rannis) administers most of the available funds and programmes. Research policy is a national-level policy competence in Iceland. The policies of the STPC are put forward in general terms without emphasis on specific sectors. A noteworthy development towards strengthening the innovation sector in Iceland was taken by the launching of a Ministerial Action Plan "Frumkvæði og framfarir " in December 2015.

The general elections of April 2013 resulted in a centre-right coalition government made up of the centre-right Independence Party and the centre-agrarian Progressive Party. In its coalition platform, published in May 2013, the government emphasizes innovation in all sectors.

Science and research policy in Iceland takes into account developments within the ERA, and the *Iceland 2020 Policy Statement* mirrors many of the ERA's key goals and objectives.

Iceland has contributed approximately 2.7 to 3.0% of its GDP to development and research over the past decade. Public R&D expenditure peaked in 2008 and 2009 with an R&D intensity of 3.11 % in 2009. The longer-term impact of the banking crisis was seen in 2011 with expenditure cut by 10%. Expenditures stood at 2.4 % in 2011 and remained the same through 2012. In 2013, expenditures stood at 1.87% of GDP whereas in 2014 it stood at 1.89% of GDP (Statistics Iceland, September 2015).

Allocations for the budget years 2015 and 2016 were increased by close to 40% in public R&D expenditures, compared with 2014 levels. They are still far from the government's R&D intensity target of 3% by 2016 and 4% by 2020. To achieve this objective, funding from the private sector is mostly needed.

In 2015, the Icelandic economy can be described as stable. Despite moderate growth, it faces challenges that put a strain on the Icelandic RDI landscape. Following a deep and long recession, including the banking collapse in 2008, an economic turning point was reached in 2011, when the economy began to grow again. In 2014, GDP per capita stood at € 39,500, compared to the EU average of 27,300, and a GDP growth rate of 1.9, compared with the EU average of 1.3. Post-crisis budget cuts and capital controls, implemented to prevent capital flight following the banking collapse in 2008, remain partially in place. This has created difficulties for growing companies and has had an impact on RDI.

In December 2013, the Prime Minister published the new policy of the Icelandic *Science and Technology Policy Council* . The strategy has four main goals, namely:

1) Growth and economic value creation; to increase the impact of science and innovation funding
2) Human resources; a goal-oriented and diverse education system from the primary to the tertiary level

3) Collaboration and efficiency; an active collaboration between business and research education institutions
4) Results and follow-up; improved evaluation of the quality of research and innovation and of the economic value created

In May 2014, the STPC followed up on its 2014-2016 policy with the adoption of a 21-step Action Plan with a clear time-line to support the four main goals. Many of these actions materialized in 2014 and 2015.

This is the first time that the STPC draws up a special action plan, featuring specified responsible parties, a cost analysis and fixed time limits. Both the STPC's 2014-2016 policy and the *May 2014 Action Plan* express, albeit indirectly, commitments towards the ERA objectives. Full allocation for the action plan was seen in the State Budget for 2015 as well as 2016.

Assessments of the research and innovation system in Iceland have repeatedly pointed to the fragmentation of the system as well as to the need for much more collaboration between public and private actors. In its 2014 peer-review evaluation of Iceland's R&D system, the European Research and Innovation Area Committee (ERAC) arrived at four key findings, namely;

1) a lack of political support for Iceland's science and innovation system;
2) an increased need for a future-oriented vision and strategy;
3) a lack of transparency and accountability;
4) the need for evidence on efficiency and effectiveness.

As strengths, the report highlighted that the Icelandic government had taken a number of important steps in 2014 to act on some of those challenges, changes that had taken place in parallel to the writing of the peer-review report. This applies in particular to the adoption of the May 2014 STPC Action Plan and the subsequent implementation until September 2014, when the evaluation was published.

In terms of the EU's Innovation Union Scoreboard 2015, Iceland is placed into the second (of four) performance categories, i.e. as *Innovation Follower*, with an above EU-average performance.

1. Overview of the R&I system

1.1 Introduction

With only 330,610 inhabitants (equivalent to 0.06 % of the entire EU population), Iceland is among the smallest economies in Europe. It is only around 1/25 of the Danish economy, ¼ of the economy of Luxembourg, but around 50% larger than the economy of Malta (Central Bank of Iceland, September 2014). The small size of the Icelandic economy is important to keep in mind when providing an overview of the Icelandic RDI landscape. It is also important to keep in mind that two thirds of the Icelandic population live in the capital area (Reykjavik and surrounding municipalities), where almost all of Iceland's research activity also takes place.

In 2015, the Icelandic economy can be described as stable. Although growing at a moderate pace, it is faced with challenges that put a strain on the Icelandic RDI landscape. In 2014, the GDP growth rate was 1.9% and thus higher than the EU average of 1.3%. Between 2012 and 2014, GDP increased steadily, with real GDP growth rates of 1.3%, 3.6% and 1.9%, respectively, compared to the EU averages of -0.5%, 0.1% and 1.3% for the same period. In 2014, GDP per capita stood at € 39,500, compared to the EU average of € 27,300. Since the 2008 banking collapse, economic progress has been made on many fronts; inflation has decreased, external imbalances have narrowed, and public debt is falling.

The seasonally adjusted unemployment rate was 4.2% in August 2015 (Statistics Iceland, September 2015), which is very low compared to the EU average. Traditionally, unemployment rates have been among the lowest in Europe. After the peak years of 2009 and 2010, in the aftermath of the 2008 crisis, unemployment has again been on a steady decline, with 2012-2014 rates measuring at 6%, 5.4% and 5% respectively, compared with the EU average of 10.2% in 2014. Labour mobility provides part of the explanation, as many left Iceland to find employment abroad, with Norway being the most popular destination. Many of these were individuals with university degrees, such as nurses and doctors. A number of initiatives were launched by the state in cooperation with local governments, unions and employees to reduce unemployment. Businesses were given incentives to hire and retraining was facilitated for the unemployed to retrain. (ERAWATCH, 2013)

Iceland has been part of the European Union's single market via the Agreement on the European Economic Area (EEA) since its entry into force in 1994. Research and development is further covered by Protocol 31 to the EEA Agreement. The EU is Iceland's main trading partner. In general, the small Icelandic economy has a relatively low level of diversification, particularly with regard to exports. The import structure is more diversified. Recent years have also seen rapid growth in tourism. A number of export-oriented manufacturing companies have emerged in the last 20 years. Most of these companies are founded on product innovation, R&D and information and communication technologies (ICT). Three of these companies have grown from being small or medium-sized companies to become key international players in their field, holding a relatively large market share worldwide in medical equipment, pharmaceuticals, and food processing and fishery equipment, respectively. Exports from these companies amounted to 9% of exported goods in 2013, compared to 6.5% in 2000 (Central Bank of Iceland, September 2014).

As an EEA member, Iceland's framework for research and innovation policy is comparable to those of the EU Member States. Iceland participates in the European Research Area (ERA) governance structures and participates in some of the EU's main research and Innovation programmes, including *Horizon 2020*, *Erasmus+* and *Creative Europe*.

In its coalition platform from May 2013, the Icelandic government emphasizes innovation in all sectors, stating that productivity needs to be increased and that a premise for long-term

growth is an environment that encourages innovation in existing enterprises, public operations and new undertakings. To ensure optimal utilisation of funding for research and development, the government emphasises coordinating the operating base of public institutions responsible for R&D. The platform envisages efforts to be directed at integrating public programmes and drafting special regional programmes in collaboration with municipalities. It aims at stimulating cluster strategies in order to create synergies between companies to undertake larger development tasks as well as to improve access of start-ups to equity capital (Icelandic Prime Minister's Office, May 2013)

The *Iceland 2020 Policy Statement* mirrors many of the key goals and objectives of the ERA, including setting targets for a more effective and competitive national system, defining objectives for international cooperation and setting goals to increase gender equality (Icelandic Prime Minister's Office, 2011).

Total R&D expenditure (GERD) in 2014 stood at € 264.4m (1.89% of GDP), an increase by 7% from the year 2013, which amounted to 1.87% of the GDP (Statistics Iceland, September 2015).

This is still far from Iceland's set R&D intensity targets of 3% by 2016 and 4% by 2020. To achieve this objective, the government has increased the contribution for R&D in the 2015 State Budget and offered tax incentives to private companies for R&D spending.

Iceland's small and open economy was severely hit by the crisis in October 2008, when the country's three major banks collapsed and the government lost access to international capital markets. The stabilization programme conducted with international support was successfully completed in 2011 and economic activity has recovered steadily, returning to its pre-crisis level earlier than in countries affected by the Eurozone debt crisis (OECD, July 2015).

The effects of the financial and banking crisis were also strongly felt in reduced funding for research and development, in particular private funding. Another strain put on the R&D landscape has been the implementation of capital controls to prevent capital flight following the banking collapse in 2008. Although these controls are partially still in place, major steps to remove them were taken in 2015. Until they are fully removed, this nonetheless creates difficulties for growing companies, as capital controls tend to to reduce the supply of capital and raise the cost of financing, especially in the longer term. This poses a particular challenge for a small economy such as Iceland, which does not have access to international capital markets or the backing of the European Central Bank. In the period 2012-2015, Iceland has experienced many seed ventures and start-ups moving abroad in order to secure venture capital.

In 2013, Iceland's innovation performance was below its level in 2007, but 2014 already saw signs of recovery. Performance relative to the EU stood at 12% above average in 2014 (European Commission, 2015).

Table 1 Main R&I indicators 2012-2014

Indicator	2012	2013	2014	EU average (2014)
GDP per capita	34,400	35,700	39,200	27,400
GDP growth rate	1.2	3.9	1.8	1.4
Unemployment rate as percentage of the labour force	6%	5.4%	5%	10,2
GERD in €m	n.a	216.7	242.9	10,139
GERD as % of the GDP	n.a	1.87%	1.89%	2.03%
GERD (EUR per capita)	n.a	673.3	745.8	560.1
Employment in high- and medium-high-technology manufacturing sectors as share of total employment	1.4%	1.5%	1.7%	5.7%
Employment in knowledge-intensive service sectors as share of total employment	48,2	48,1	47,8	38,8

1.2 Structure of the national research and innovation system and its governance

1.2.1 Main features of the R&I system

R&I policy development and implementation is addressed at the national level and has a regional dimension only to a limited extent, mainly through the functioning of the Icelandic Regional Development Institute (Byggðastofnun). The institute is an independent institution that reports to the Ministry of Industries and Innovation and supports eight industrial regional development agencies in Iceland, one in each constituency. The regional actors include municipalities, trade unions, businesses and various other parties interested in promoting innovation and economic growth. The Regional Development Institute liaises with experts from universities, the industry and investment funds in its efforts to stimulate cooperation projects in the form of grants and assistance.

The University of Iceland's Institute of Research Centres is a venue for the University's collaboration with local authorities, institutions, businesses and individuals in rural areas. Its objectives are to meet the demand for research and education all over Iceland, to provide facilities for research projects dealing with local environmental and societal conditions, to provide facilities for students' field work, to increase access to research based education in rural areas, and to strengthen the University's ties to local enterprises and daily life in rural areas. Seven Research Centres are currently run by the Institute. The centres are generally considered to have a positive impact on rural

societies by enabling young researchers to make a career in research outside the capital area.

In 2014, the share of the different sectors in the total R&D expenditures was as follows: enterprises, 57%; higher education sector 35% ; and government sector pooled with the private non-profit sector, 8%. (Statistics Iceland, September 2015)

1.2.2 Governance

The *Science and Technology Policy Council* (STPC) is the main policy-making body in charge of design and coordination of Iceland's R&D policy. The STPC sets the official science and technology policy for a period of 3-4 years at a time. When the Council was established in 2003, science and innovation policy was elevated to a higher level than before, economically as well as politically. The STPC is an inter-ministerial council, headed by the Prime Minister, and is composed of various independent experts, nominated by line ministries responsible for delivering the government's main policy in this field as well as from representatives of the Icelandic Confederation of Labour and the Confederation of Icelandic Employers. In addition to the Prime Minister, three other ministers, namely the Ministers of Finance and Economic Affairs; Education, Science and Culture; and Industries and Innovation, respectively, have a permanent seat. The role of the council is to support scientific research, science education and technological development, and to generally increase the competitiveness of the economy. The council's deliberations are prepared by its working committees in each of the two fields: the Science Board and the Technology Board. The council meets four times a year, but the operationalization of the council's policy is undertaken by line ministries that are largely independent and autonomous.

The Ministry for Education, Science and Culture is the key ministry in charge of R&D policy in Iceland, but other line ministries also play a role in implementing the policy, in particular the Ministry for Industries and Innovation, due to responsibilities for research organisations in the respective industrial fields.

Several other public bodies are responsible for promoting research and innovation in Iceland. The *Icelandic Centre for Research* (Rannis) plays a key role at an operational level in supporting research, innovation and culture in Iceland as well as in disseminating information. Rannis reports to the Ministry of Education, Science and Culture and serves the Icelandic science and technology community as a whole. It provides technical support to the *Science and Technology Policy Council* as well as to funding bodies. Rannis also manages and follows up on the implementation of most research programmes (including *Horizon 2020*, *Erasmus+*, the *EEA Grants* and *Creative Europe*) and administers most of the competitive funds available in Iceland.

Innovation Centre Iceland (www.nmi.is) is an R&D business support institute. It is divided into two units: The Technology Research and Consulting Unit and Innovation and Entrepreneur Services (IMPRA). IMPRA assists entrepreneurs nationally by evaluating business ideas and providing assistance. IMPRA runs the Icelandic Enterprise Europe Network office (ENN) to encourage cooperation between Icelandic and European companies.

In the private sector, the *Icelandic Federation of Trade* and the *Iceland Chamber of Commerce* are the main organisations representing the business sector. The former is a trade association that represents Icelandic companies; the latter collects data, conducts surveys and monitors the business sector and provides information about the state of Iceland's businesses. Both organizations provide input and advice to decision-makers on various aspects of competitiveness.

1.2.3 Research performers

There are currently seven accredited and operational Higher Education Institutions (HEI). Four are public, two are non-profit organisations and one is a limited liability company (LLC). Two higher education institutions are accredited for PhD training,

namely University of Iceland and Reykjavik University. All of Iceland's seven universities (private and public) receive public funding.

In Iceland, universities, both public and private, are financed and controlled by the Ministry of Education, Science and Culture . They have private boards and have a significant degree of autonomy.

Quality assurance of higher education institutions, as regards both research and teaching, is carried out by the Icelandic Quality Board for Higher Education. Periodic external evaluations were carried out and completed in all of the HEI's in the period 2014-2015 (see also section 2.2.1 - evaluations).

The leading public HEI, the University of Iceland, is the only university offering a complete range of disciplines. It is also the most significant public R&D performer. In 2006, the University of Iceland set itself the long-term goal of becoming one of the top 100 universities in the world. In the *University of Iceland Policy for 2011-2016*, strong emphasis is placed on strengthening the role of research, innovation and internationalization. The policy spells out ambitious goals towards that end, including strengthening the university's international scientific community, e.g. to facilitate recruitment of the world's leading scientists, to strengthen the activities of the University of Iceland's Research Centres located around Iceland (see also section 1.2.1.) and to support services for grant applications to competitive funds and patent applications (University of Iceland, 2010). The university's 2011-2016 policy also recognizes the need to diversify and expand funding from non-governmental sources, e.g. international and domestic competitive funds.

In 2015, the University of Iceland ranked at 222 among the world's 300 best universities in the Times Higher Education World University Rankings.

In celebration of the centenary of the University of Iceland in 2011, the Icelandic Government and the Parliament established the *University of Iceland Centennial Fund* to strengthen the university and support research and innovation at the University. In 2013-2015, the fund has funded the appointment of 15 new post-doctoral researchers and 8 Assistant Professors, all appointed through international competition with an emphasis on achieving international research excellence.

Regarding research performers in the private sector, five companies stand out as the largest contributors to private R&D investment, namely:

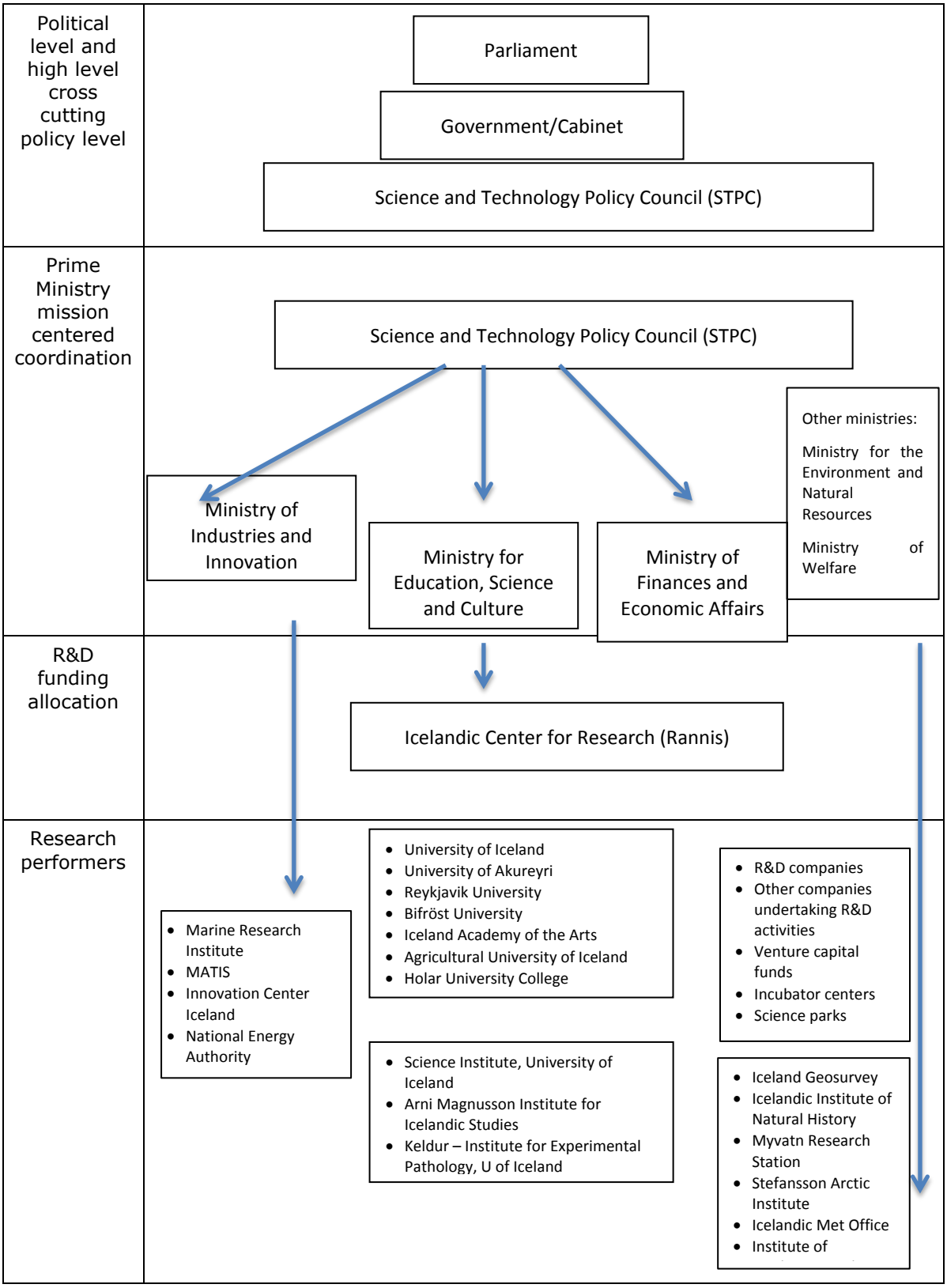
a) Actavis, a global pharmaceutical company;
b) CCP Games, a video game developer;
c) Decode Genetics, a biopharmaceutical company;
d) Marel, a global provider of advanced food processing equipment;
e) Össur, a company that manufactures orthopedics equipment.

Actavis will however move its operations out of the country in 2016.

Out of these five, Marel is the only one to be ranked on the 2014 EU Industrial R&D Investment Scoreboard, which contains economic and financial data for the world's top 2500 companies. With € 53.7m of investments in research and development efforts in 2014, Marel is ranked in 1120th place.

On the horizon as a major research performer is an international privately-owned pharmaceutical company, namely Alvogen. The company plans to invest € 176 m (ISK 25 bn) over the course of the next few years, a quarter of which will be used to construct a research and development centre adjacent to The University of Iceland. The plan is to house Alvogen's international offices as well as facilities for the development and production of biotech-pharmaceuticals. Construction of the house started in November 2013; once completed, it is estimated to employ over 200 people in the pharmaceutical industry.

Figure 1 Diagram of the R&I System in Iceland



2. Recent Developments in Research and Innovation Policy and systems

2.1 National R&I strategy

Iceland's main policy-making body in charge of design and coordination of R&D policy is the *Icelandic Science and Technology Policy Council* (STPC). The STPC sets the official science and technology policy for a period of 3-4 years at a time. The current STPC strategy was formally endorsed by the Icelandic Government in November 2013 and has a time horizon until 2016. It builds upon a "white book" from 2012 under the title "New vision – changes in the science and innovation system", which describes a five-year vision regarding research, science and innovation, based on various growth challenges across different sectors of the economy. The 2012 "white book" highlights the need for enhanced cooperation between universities and research institutions and stresses the importance of increased investments in R&I in order to meet new challenges (Icelandic Prime Minister's Office, 2012).

The 2012 policy paper established a foundation for the current cornerstone of R&I policy, namely the **Science and Technology Policy and Action Plan 2014–2016.** The complete Action Plan and Policy can be found on the STPC's web site at www.vt.is.

This is the first time that the STPC draws up a special action plan, featuring specified responsible parties, a cost analysis and fixed time limits. Each action is made the responsibility of either a ministry or a public institution, and the cost of each action has been assessed. The policy expresses, albeit indirectly, commitments towards the ERA objectives of vastly increasing contributions to competitive funds and makes reference to the EU's R&I Framework Programme, mainly by stating that Iceland should align funding rule criteria to those of Horizon 2020.

The strategy addresses R&I in an integrated fashion and can be described as a smart specialisation-type of policy as it covers industrial, educational and innovation policies and identifies a number of priority areas for knowledge-based investments with a focus on Iceland's strengths.

The policy was adopted by the Icelandic government in late November 2013 and published in December 2013.

The policy's four main themes are:

1. to stimulate growth and create economic value by increasing the impact of science and innovation funding, both in the private and public sector. Tangible near-term goals include an increase in science and innovation funding in relation to GDP, with a target of 3% of GDP by 2016; a strengthening of the financing of the Icelandic higher education system, aiming to reach a level at least comparable to the average of the OECD member states by 2016; an increase in competitive financing as a percentage of the funding of higher education and research institutions to approximately one-third of total funding by 2016; the introduction of financial contributions based on performance assessments as a complement to open competitive funds; the creation of a transparent financial environment for higher education and research institutions, clearly linking contributions to performance and quality benchmarks; ensuring that rules applied by Icelandic competitive funds regarding indirect costs and own contributions are aligned with international developments, such as within Horizon 2020; the strategic use of the tax system to encourage private companies and individuals to invest in scientific research and innovation and to draw up an action plan for Iceland's participation in international research programmes, in particular where Icelandic participation must be financed through contributions from public funds.

2. to ensure the supply of human resources for science and innovation by forming a goal-oriented and diverse education system and to increase recruitment in the research and innovation sector. Near-term goals include:

strengthening doctoral education, strengthening science and technology education, shortening the education process, increasing cooperation between companies, research institutions and the education system and ensuring the international competitiveness of the Icelandic labour market for those engaged in scientific research and innovation.

3. to increase collaboration and efficiency in the system by strengthening active cooperation between universities, research institutions and companies for the purpose of increasing impact and efficiency. Set goals include; a revision of the organization and legal framework of the Icelandic science and innovation system, simplify the relevant legislation and move toward increased integration; organise mergers between higher education institutions, research institutions and research centres, where appropriate; increase the number of funding opportunities and incentives promoting collaboration between educational institutions, research institutions and industry; define projects that require long-term funding and ensure that they receive funding and can be applied in research and innovation.

4. to improve evaluations, results and follow-up of the science and innovation output and value creation. Evaluate the quality and impact of research and innovation activities and support continuous reform. Set near-term goals include developing a comprehensive information system of the results of research and innovation; to evaluate the quality and the results of R&I activities in line with international criteria and to improve statistics on the Icelandic R&I economy.

At the political level, the Icelandic government has agreed to provide funding for the plan, but this is subject to the budgetary process and parliamentary approval, as the Icelandic budgetary procedure calls for approval an annual level and the R&I policy, as other policies in the draft budget, are subject to political negotiations. This lack of connection between the stated government policy and how it is implemented through funding, has for long been pointed out as a weakness of the Icelandic R&I policy (see further chapter 6). Significant efforts towards implementation were however seen in 2015, both in terms of concrete actions as well as in the 2015 state budget. It remains to be seen (likely to be passed in December 2015) if the budgetary process for the 2016 State Budget will pursue these commitments further but it is clear that the 2015 increase to R&D in the State Budget has materialized and it can be considered likely that the government will pursue this planned increase in 2016.

2.2 R&I policy initiatives

A noteworthy development towards strengthening innovation in Iceland was taken by the launching of a Ministerial Action Plan "Frumkvæði og framfarir " of December 2015. The action plan consists of 22 measures towards creating a more efficient working environment for innovation in Iceland. These measures include access to finance for entrepreneurs and start-ups, simplification of regulatory framework for entrepreneurs and start-ups, measures towards improving the working environment and public support for entrepreneurship in general, envisaged creation of an online Registration of Private Limited Companies, a foreseen set-up of an *inventory of funding possibilities* for entrepreneurs and start-ups,

as well as measures towards strengthening the international collaboration in this field in general. At the time of the writing of this report in January 2016, the first measure in the action plan has already been implemented with the parliamentary decision on the 2016 State Budget from 19 December 2015 to increase the allocation to the Icelandic Technology Development Fund by € 6,8 m (ISK 975 million) compared to the previous year. As of January 2016, the fund has already started promoting new funding opportunities which will fully materialize later in 2016.

As explained above, the current national R&I strategy of the Science and Technology Policy Council for 2014–2016 is complemented by a 21-point Action Plan specifying clear

objectives, deliverables, responsible parties, a cost analysis and fixed time limits with milestones. For each action, the Action Plan assigns an actor – either a ministry or a public institution - responsible for its implementation and a chair from the Prime Minister's Office oversees the implementation process. The policy is integrated in that the policy sets goals that are intended to support research, innovation and education aspects. Investment in research infrastructures are included in the policy.

Several of the 21 Action Plan initiatives call for amendments to laws and regulations, as well as necessary budgetary increases and, as explained before, the financing of the plan is subject to the budgetary process and parliamentary approval. However, as many of the points have already been implemented, it is widely expected that the new STPC policy and the 21-point Action plan will have a significant impact on the science, technology and innovation system and performance of Iceland.

Up to January 2016, several of them have already been implemented or work has started:

Firstly, on the basis of the 21-point Action Plan, an increase of ISK 800 million (€ 5,6 m) was provided in the 2015 State Budget allocated for public competitive funding. An even higher increase of ISK 2 bn (€ 14 m) was allocated in the 2016 State Budget proposal. These two year-on-year increases are directed at the two largest R&I funds; the Research Fund and the Technology Development. This amounts to almost doubling of the size of these two funds from 2014 to 2016.

In addition to the 21-point Action Plan, the Ministry of Education, Science and Culture has started work towards setting a five year strategy for the higher education institutions, with the goal of increasing excellence, efficiency, quality and collaboration in the system The new strategy will have time-horizon until 2019 (ERAC, 2014, page 2). The strategy will extend to all of Iceland's universities, research institutes and knowledge centres, the Icelandic Student Loan Fund and the Research Centre of Iceland, Student Loan Fund and the Science and Technology Policy Council (Icelandic Ministry of Education, 2015-6).

One interim report has been published at the time of the writing of this report, namely "Háskólar og vísindi á Íslandi 2015, þróun og staða" which gives a detailed account of the state of play of the Icelandic HEIs. The report is mandated to serve as a ground on which the five-year strategy will base its recommendations (Icelandic Ministry of Education, 2015-6).

This new five year strategy is expected to be presented in late 2016.

Another process that was started in the spring of 2015 was the formation of a committee mandated to draft amendments to the framework legislation for research institutes. The committee's mandate is to produce concrete proposals by 2016 to reduce fragmentation in the system and to increase collaboration and efficiency of the R&I policy actors, but also to simplify and merge existing legal frameworks of research institutes as to better coordinate their activities and functions. The committee has started its work but has not made any concrete actions public, at the time of the writing of this report in January 2016.

A part of the ISK 800 million (€ 5,6 m) increase in the 2015 State Budget was earmarked for strengthening the PhD education in Iceland. The aim is that by 2016, 200 PhD positions will be fully financed by the national competitive funds (Icelandic Prime Minister's Office, STPC, 2014)

A new Funding Program (*Markáætlun*) for human resources in science and innovation has been established.

Important steps were taken in 2014 and 2015 towards increased evidence-based policy making. A total of ISK 10 m (€ 70,000) was provided in 2014 and 2015 to Statistics Iceland to underpin new responsibilities and tasks, many of which were transferred or taken over from Rannis, e.g. the responsibility for gathering and processing data on

research and development expenditures and on innovation levels. This task takes the form of two surveys, each of which is carried out every two years in collaboration with Eurostat; one survey on R&D expenditures; measures on innovation levels among companies (Community

Innovation Survey – CIS). In 2014, Statistics Iceland started work on producing business statistics for the first time, broken down by sectors and regions (Icelandic Prime Minister's Office, STPC, 2014). Funding was secured in 2014 and 2015.

In December 2015 for the budget year 2016, a total of 70 million ISK was allocated for a new information system that will provide the Icelandic authorities as well as the management of the institutions detailed information for decision making and the setting of strategies and policy goals (Icelandic Prime Minister's Office, STPC, 2014)

2.2.1 Evaluations, consultations, foresight exercises

Following a request by Icelandic authorities in 2013, the *European Research and Innovation Area Committee* (ERAC) carried out a peer-review evaluation of Iceland's overall science and innovation system in 2014. The review was carried out by a group of international experts that worked in collaboration with experts from the European Commission. The process officially started in December 2013 and ended with the publication of a final report published in September 2014. The four key findings of the peer review pointed to a lack of political will and support for Iceland's science and innovation system and a dire need for a future-oriented vision and strategy. The reviewers noted that the Icelandic government had indeed taken a number of very important steps in 2014 (during and immediately after the report was written) to act on many of the challenges highlighted in the report. In particular, the May 2014 Action Plan was named as an important step. However, lack of transparency and accountability were viewed as a major challenge. The same applies to the need for evidence on the efficiency and effectiveness of the R&D support system (ERAC, September 2014). The peer-review report put forth three key messages to the Icelandic government:

1) *"that the government should place science and innovation more prominently on the political agenda and thereafter ensure the follow-up of the actions implemented."*
2) *"that changes are needed at the level of universities, research institutions and industry, and could be achieved for instance by means of inviting all actors to contribute proposals on the possibility of "budget neutral" collaborations."*
3) *"that there is a clear lack of evidence and evaluations. In that regard, which could be resolved, as the panel recommended, through a transformation in efforts towards a systematic publication of data and indicators, on the basis which assessments could be made."*

One of the elements within the Quality Enhancement Framework for Icelandic higher education consists of the quality board-led reviews at the institutional level. The first cycle of these reviews span the period 2011-2016 and by end of 2015, all seven Higher Education Institutions (HEIs) in Iceland had undergone an extensive institutional review. Two of the HEI's, Bifröst University and Hólar University College initially received limited confidence in their reviews, which by end of 2015, all had been upgraded to confidence. All of the final reports made can be found on the website of the Quality Board for Icelandic Higher Education.

One of the observations of the 2014 ERAC peer review, regarding Iceland's research performers, was that there were were many missed opportunities for better coordination between the educational system and the needs of the industries in Iceland. "In the knowledge-intensive industries, there is a lack of people with technical skills and expertise, and the proportion of university graduates from the natural sciences and technology is very low" (ERAC, 2014).

2.3 European Semester 2014 and 2015

Iceland is not a member of the EU and does therefore not participate in the National Reform Programme.

2.4 National and Regional Research and Innovation Strategies on Smart Specialisation

Iceland does not receive structural funds and Icelandic authorities do not make formal use of the S3 strategy.

2.5 Main policy changes in the last years

Main changes in 2012
Publication and adoption of a 5-year policy vision: "New vision – changes in the science and innovation system". The policy describes a medium-term vision regarding research, science and innovation, based on global challenges. The 2012 "white book" highlights the need for enhanced cooperation between universities and research institutions and stresses the importance of increased investments in R&I in order to meet new challenges.
Main changes in 2013
Adoption by the Icelandic government in late November 2013 of a new national R&I strategy of the Science and Technology Policy Council for 2014–2016 New legislation "Infrastructure Fund" (Law 149/2012) entered into force, amending the framework legislation "Act on Public Support for Scientific Research" (Law 3/2003) allowing for a change to the previously named "Equipment fund" to "Infrastructure Fund". The role of the fund is expanded significantly and transparency of allocation increased. Support to research infrastructure is expanded and financing access to infrastructures made easier. The "Infrastructure Fund" offers several types of grants: equipment grants; build-up grants; access grants; update grants.
Main Changes in 2014
Statistics Iceland takes over from Rannis the responsibility for gathering and processing data on research and development expenditures and on innovation levels. This task takes the form of two surveys, each of which is carried out every two years in collaboration with Eurostat; one survey on R&D expenditures; measures on innovation levels among companies (Community Innovation Survey – CIS). In 2014, Statistics Iceland started work on producing business statistics for the first time, broken down by sectors and regions.
Main Changes in 2015
Adoption and beginning of implementation of a 21-point Action Plan supporting the national R&I strategy of the Science and Technology Policy Council for 2014–2016, featuring clear objectives, deliverables, specified responsible parties, cost analysis and fixed time limits. Structural changes and significant increase in the State Budget for for competitive funds. Development towards strengthening the innovation sector with the launching of a Ministerial Action Plan "Frumkvæði og framfarir " in December 2015.

3. Public and private funding of R&I and expenditure

3.1 Introduction

The *Iceland 2020 Policy Statement* mirrors many of the key goals and objectives of the ERA. Total expenditures for R&D (GERD) in 2014 stood at € 262.1m or 1.89 % of GDP. This is still far from Iceland's set R&D intensity targets of 3% by 2016 and 4% by 2020.

Out of the total expenditures for R&D as percentage of GDP, the business sector accounted for 1.07%, the higher education sector for 0.67% and the government and private non-profit for 0.15%.

Year-on-year, this is an icrease in GERD expenditures, as measured GERD in 2013 stood at ISK 35, 189 million (circa €245.3 m) or 1.87% of the Icelandic GDP (Source: Statistics Iceland, September 2015) Of the total R&D expenditures in the business enterprise sector, 67.1% was in services of the business economy, while 24.1% was in manufacturing (Statistics Iceland, April 2015).

The share of the different sectors in the total R&D expenditures is as follows: enterprises € 149.1m in 2014, from € 139.4 billion in 2013; higher education sector € 92.7m in 2014, from € 87.1 m in 2013; and government sector pooled with the private non-profit sector € 20.9m, from €19.5 in 2013 (Source: Statistics Iceland, September 2015, with *InforEuro* currency rate of October 2015).

In 2014, research and development expenditures in the service sector amounted to € 89.2 m, or 60.1% of the total R&D expenditures of enterprises, while R&D in manufacturing was € 46m, or 31.5% of total expenditures or enterprises (Source: Statistics Iceland, September 2015, with *InforEuro* currency rate of October 2015).

In the higher education sector, the field of science with the highest R&D expenditures in 2014 proved to be; social sciences, with € 27.1 m; but the second highest expenditures were in medical and health sciences, € 23 m. In other fields of science the R&D expenditure was as follows: natural sciences, € 17.4 m; engineering and technology, € 9 m; humanities, € 8.3 m; and agricultural sciences, € 6.9 m (Source: Statistics Iceland, September 2015, with *InforEuro* currency rate of October 2015). The number of researchers in the higher education sector increases from 1,910 to 1,955 between years, of which PhD students were 248 in 2014, but 233 in 2013. Full-time equivalent researchers increased from 1,011 in 2013 to 1,033 in 2014 (Statistics Iceland, September 2015).

Following the 2008 financial and banking crisis in Iceland, R&D intensity (R&D expenditure as a percentage of GDP) went down to 2.4% in 2011 after having already reached a high of 3.11% a few years before. After 2011, however, the Icelandic economy started growing again and has kept comparatively high growth rates since then. Growth rates measured at 1.2 in 2012 (against a –0.5 rate in the EU28), at 3.9 in 2013 (against a 0.2 rate in the EU28) and at 1.8 in 2014 (against a 1.4 rate in the EU 28), (Eurostat, 2015 - Code: tec00115).

The same gradual progress was seen in Icelandic households. In 2014, disposable income of households increased by 7.7% compared with 2013 and per capita income increased by 6.5 % between the years (Statistics Iceland, 2015). The EU2020 target of total national expenditure (GERD) on R&D reaching 3% of GDP was officially adopted by the Icelandic government in 2013 with the approval of the STPC policy in November 2013. The government has since then confirmed the target and introduced a timeline, setting the goal of reaching the 3% goal by 2016 and a goal of reaching 4% of national expenditure of GDP by 2020, with the private sector contributing 70% of the total and the public sector contributing 30%. (STPC, 2013).

Total expenditures for research and development in the year 2014 were €245.9 m (ISK 37,603 million), which amounts to 1.89% of the Icelandic GDP of that year. The R&D expenditures increased by 7% from the year 2013, which amounted to 1.87% of the

GDP. The data collection covers enterprises, the higher education sector, government sector and the private non-profit sector. The share of the different sectors in the total R&D expenditures in 2014 is as follows: enterprises € 139,9 m (ISK 21.4 bn); higher education sector € 86 m (ISK 13.3 bn) and government sector pooled with the private non-profit sector € 19 m (ISK 3 bn) (Statistics Iceland, September 2015).

Iceland's small and open economy was severely hit by the crisis in October 2008, when the country's three major banks collapsed and the government lost access to international capital markets. The stabilization programme conducted with international support was successfully completed in 2011 and economic activity has recovered steadily, returning to its pre-crisis level earlier than in countries affected by the Eurozone debt crisis (OECD, July 2015).

Iceland does not participate in EU's Structural Funds.

Iceland has been active and quite successful in the last EU programme (2007-13). Icelandic researchers were involved in 219 projects, receiving funding of nearly €70 m. As of 2014 or from the time of the launching of Horizon 2020, Iceland has participated in 40 projects. The country is generally deemed to have an excellent science base and clear strengths in specific fields, mainly geothermal energy production, climate change and marine biodiversity.

Table 2 Basic indicators for R&D investments

Indicator	2011	2012	2013	2014	EU average (2014)
GERD (as % of GDP)	2.5%	n.a.	1.87	1.89	2.03
GERD (Euro per capita)	825,3	n.a	673,3	745,8	558,4
GBAORD (€m)	102,583	111,404	122,823	125,378	92828,145
R&D funded by BES (% of GDP)	1,32%	n.a	0,73	n.a	n.a
R&D funded by PNP (% of GDP)	0,01	n.a	0	n.a	n.a
R&D funded by BES (% of GDP)	1.24%	n.a	0,73	n.a	n.a
R&D funded from abroad	0,20	n.a	0,38	n.a	n.a
R&D performed by HEIs (% of GERD)	0,66	n.a	0,11	n.a	1.3
R&D performed by government sector (% of GERD)	0.44	n.a	0.12	0.12	0.25
R&D performed by business sector (% of GERD)	1.32	n.a	1,06	1.07	1.3

3.2 Smart fiscal consolidation

Iceland does not receive Structural Funds and the national authorities currently have no ambition to relate to or develop a National Research and Innovation Strategy for Smart Specialisation (RIS3).

As explained in chapter 3.6, a new Organic Budget law was passed in December 2015 that builds on recent good practices – including that of the EU - to improve the fiscal framework and the budget process. It is generally anticipated that this will strengthen budget discipline in Iceland and provide stability and continuity, including to public R&D expenditures.

3.3 Funding flows

3.3.1 Research funders

Regarding the structure and functioning of public funding in Iceland there are several public research and innovation funds operating, all on the basis of the national R&I strategy of the Science and Technology Policy Council.

Generally, public research funds in Iceland can be described as "open" and "competitive" with emphasis on research, or on innovation (or both). They do generally not focus on specific societal challenges as is the case with many comparable countries.

There is not a strong tradition of private parties funding either research or innovation in Iceland. As a result, no private research foundations exist, only very small-scale private research funds with limited financing capacities.

A complete list of public competitive funds is to be found in Annex 4, but the three largest will be highlighted:

These are 1) the Icelandic Research Fund 2) the Technology Development Fund and 3) the Infrastructure Fund. All three funds are administered by the Icelandic Centre for Research -Rannis.

The first two, i.e. the Icelandic Research Fund and the Technology Development Fund, are by far the largest public funds on research and innovation. The Icelandic Research Fund and the Infrastructure Fund fall under the auspices of the Ministry of Science, Education and Culture, while the Technology Development Fund operates under the auspices of the Minister of Industry and Commerce.

1. The Icelandic Research Fund is an open competitive fund which provides research grants according to the general priorities of the Science and Technology Policy Council and based on peer review of proposals. The role of the fund is to enhance scientific research (basic and applied). The fund offers funding to research students and defined research projects led by individuals, research teams, universities, research institutes, and companies. Up to 90% of the funding of the Icelandic Research Fund is allocated to doctoral students and post-doc positions and grants for specified research projects. There are several types of grants allocated under the fund including project grants, grants of excellence and doctoral and postdoctoral grants.
2. The Technology Development Fund's role is to support R&D projects that lead to the regeneration and improved competitive situation of the Icelandic industry. As a competitive fund, it mainly funds applied research in companies although projects can also be carried out in cooperation with research organizations or universities. At the writing (October 2015), the Ministry of Industry and Commerce is in the process of revising the fund's rules.
3. The Infrastructure Fund (established in 2013) builds on and extends the role of the former Equipment Fund. The fund's aim is to improve support for research infrastructure. The infrastructure funds creates new possibilities including for

projects already funded by the Icelandic Research Fund. This includes co-financing purchase of equipment, databases, software and any other research infrastructure.

3.3.2 Funding sources and funding flows

Over 80% of the public contribution to R&D is in the form of block grants, allocated directly to institutions, set in the annual budget. This applies both to the competitive funds supervised by Rannis, to universities and to the "R&D Fund of the Ministry of Fisheries and Agriculture in Iceland" (or AVS), an independent fund supervised by the Ministry of Industries and Innovation. The Science and Technology Policy Council's current policy is to increase the share of competitive funding of research and innovation, underlined by the council's policy for 2014- 2016, envisaging an increase in the share of competitive funding from 18% in 2014 to 27% in 2016 (Icelandic Prime Minister's Office, STPC, 2014).

The Ministry of Education, Science and Culture has signed five year contracts (2012-2016) with all universities in Iceland which include performance indicators. The ministry has also signed performance contracts with knowledge centres and research institutions.

Iceland does not participate in EU's framework for Structural Funds.

There are no private funding foundations operating in Iceland.

3.4 Public funding for public R&I

3.4.1 Project vs. institutional allocation of public funding

The framework legislation governing Iceland's public R&I funding are Legislation nr. 3/2003, i.e. the "Act on Public Support for Scientific Research" (i. Lög um opinberan stuðning við vísindarannsóknir), Legislation nr. 75/2007 (i. Lög um opinberan stuðning við tæknirannsóknir, nýsköpun og atvinnuþróun) and Legislation 53/2007 (i. Lög um nýsköpunarsjóð atvinnulífsins). Some amendments have been made to the framework legislation (3/2003), the latest in 2012, allowing for a change to the previously named "Equipment Fund" to "Infrastructure Fund". The role of the fund was expanded significantly, the transparency of allocation increased and financing access to infrastructure was made easier. The "Infrastructure Fund" offers several types of grants, i.e. equipment grants, build-up grants, access grants, update grants.

3.4.2 Institutional funding

Funding for universities and research institutions in Iceland mainly takes the form of block funding (around 80%), with only general provisions as to the way it is to be spent. Governmental appropriations to research institutions are generally not based on comprehensive policy on budgetary targets, but rather on specific needs of institutions and industries. The vast majority of public project funding is appropriated to research institutions directly, without any basis in an objective evaluation of performance and quality of the work. Funding is allocated primarily on the basis of what was allocated in previous years.

Almost all recent peer reviews and assessment reports on Iceland have expressed as a serious weakness of Iceland's R&I environment, that evaluations and assessments are conducted only sporadically. Iceland also lacks a comprehensive system for monitoring and evaluation of R&I activity as well as the means to conduct impact assessment of public funds (Taxell et alia, 2009).

This very lack of transparency and accountability was furthermore considered a major challenge in the ERAC peer review, conducted in 2013-2014. The reviewers' final report emphasized a grave need for evidence on the efficiency and effectiveness of the R&D support system (ERAC, September 2014). Furthermore, the peer-review panel concluded that the existing lack of evidence and evaluations called for a transformation of efforts

towards a systematic publication of data and indicators, on the basis which assessments could be made (ERAC, September 2014).

STPC policy for 2014-2016 takes due account of this criticism. One of the four key points in the 2014-2016 strategy is to improve evaluations, results and follow-up of the science and innovation output and value creation. The aim is to evaluate the quality and impact of research and innovation activities and support continuous reform in the near future and to develop a comprehensive information system of the results of research and innovation. The aim is also to evaluate the quality and the results of R&I activities in line with international criteria and to improve statistics on the Icelandic R&I economy.

3.4.3 Project funding

A complete list of the main public funding programmes can be found in Annex 4.

Funding for competitive funds is determined in the annual state budget.

The significantly largest part of public R&D funding is absorbed by the Icelandic Research Fund (IRF) on the one hand and the Technology Development Fund on the other hand.

The target group for the Icelandic Research Fund are university researchers and research students, as well as research institutes and companies conducting research projects led by research teams. The Icelandic Research Fund (IRF) is an open competitive research fund that operates according to the Act on Public Support for Scientific Research (with later amendments). The aim of the fund is to enhance scientific research and research education in Iceland. For that purpose, the IRF awards funding to research projects led by individuals, research teams, universities, research institutes and organisations, according to the general priorities of the STPC, based on peer review of the quality of the proposed research projects, the capability of the researchers, and the available research facilities (Rannís, 2016).

On the IRF's review procedures, the Minister of Education, Science and Culture appoints a five-member board for a period of three years following nominations by the science committee of the STPC council. When appointed, the names of the board members are published on the Rannis website. The board issues rules and guidelines and makes funding decisions based on evaluations by expert panels. Each proposal is reviewed by two to three external experts and the respective expert panel. All proposals within each expert panel are ranked on the basis of the overall quality of the proposal.

In the 2016 call for proposals for the Icelandic Research Fund grants, seven expert panels in different fields of sciences have been set up. Each panel consists of up to seven active researchers selected for their expertise in their respective fields, appointed by the Science Committee of the Icelandic Science and Technology Policy Council. Each panel is to have equal gender distribution and at least two members of each panel should be professionally active outside of Iceland. The requirement for serving as a panel member is, as a minimum, a qualification equivalent to associate professor (Rannís, 2016).

The industry is the target group for the Technology Development Fund. In 2014, the State Budget's allocation to these two funds amounted to € 14.6m or ISK 2.1 billion (Source: 2015 State Budget p.97, with InforEuro currency rate of October 2015). In December 2015, Rannis announced that the Technology Development Fund will undergo significant changes in 2016, with the aim of bridging the wide gap between the academia and the industry through the formation of several new but smaller funds. The detailes of these changes will be made clear in spring of 2016.

Allocations to these two funds were increased significantly in 2015 and in the 2016 budget, compared with 2014 levels. On the basis of the 21-point Action Plan, an increase of ISK 800 million (€ 5,6 m) was granted in the 2015 State Budget and an even higher increase of ISK 2 bn (€ 14 m) was approved in parliament in December 2015 for 2016, out of which € 6.4 m will be devoted to the Icelandic Research Fund and € 6.8 m to the Technology Fund (Source: State Budget 2016, p.35-37).

Another significant allocation increase (nearly twofold, from €106m to €206m) in the 2016 budget was seen towards a small but an important fund – the Infrastructure Fund – whose purpose is to support research infrastructure in companies and research institutions by co-financing purchase of equipment and other necessary research-means, including databases and software. Allocations to the Infrastructure Fund had not been increased since 2006 which means that in relative terms, the fund had been decreasing significantly till 2016 when the trend was reversed.

The Icelandic Research Fund is designed for projects as well as for individuals, as the fund offers funding to research students and defined research projects led by individuals, research teams, universities, research institutes, and companies. Up to 90% of the funding of the Icelandic Research Fund is allocated to doctoral students and post-doc positions and grants for specified research projects. There are several types of grants allocated under the fund, including project grants, grants of excellence and doctoral and postdoctoral grants.

3.5 Public funding for private R&I

3.5.1 Direct funding for private R&I

Private R&D performers receive very limited government support. The primary private support system in place in Iceland is a tax reduction scheme, which was introduced in 2010 and allows companies tax deductions for up to 20% of costs incurred in R&I projects. In the 2014-2016 STPC policy, this scheme is expected to encourage private companies and individuals to invest in scientific research and innovation and create a more balanced public/private funding ratio for R&I in the future. The scheme applies to enterprises that carry out research and development projects which have been certified by the Icelandic Centre for Research - Rannis. The requirement for approval is that the project is an R&D project according to the definitions in act 152/2009 (universities and other public research institutions may not apply), that the the business plan is well defined and that a documented amount appropriated for research and development equals or exceeds ISK 1 million (approx. € 7,000), and that the staff have the training, education and experience in the area on which the concept of a value-adding product or service is based. According to figures from the STPC council published in 2014, the total number of applications in 2010 from companies were 78. In 2011, the applications were 118 and in 2012 and 2013, the applications were 136 and 140 respectively (STPC, 2014).

There are only very few funds that invest in start-ups and innovation companies and in general, there is scarce financing available for smaller innovation companies, be it grants equity or loans. The leading funding option is NSA Ventures (Nýsköpunarsjóður atvinnulífsins), a state-owned, but financially independent venture capital fund (i.e. no state financial contributions). The fund has since its establishment in 1998 invested in close to 150 companies. The fund has a strategic focus on investments in technology and the life sciences. The limited funding options for smaller but growing innovation companies has lead to many of them seeking funding from abroad. If they are successful, they tend to move their operations partly or completely abroad. Part of the explanation for this is that the currency controls that were established after the financial crisis are discouraging investors from moving money into the country. There is no end-to-end program in place that supports the entire value creation chain from start to finish. It is for example difficult to secure financing unless you have real estate collateral and start-ups have limited access to these.

It is the policy of the government to support innovation and innovative solution through public procurement when possible. The law on Public Procurement states in Article 1 that the aim of the legislation is to ensure the equality of companies when it comes to public procurement, to promote efficiency in the public sector by way of effective competition and to promote innovation and development when it comes to public procurement of

goods, tasks and services. There is no formal target on public procurement of innovative goods and services. The State Trading Centre advises on and encourages innovation by using public procurement and public tenders. It estimates that 12% of all public tenders include innovative criteria one way or another.

Iceland participates in a Nordic 'lighthouse project' in health care to strengthen the collaboration between Norway, Finland, Sweden, Denmark and Iceland on innovation procurement. This project was launched in late 2013 when the Nordic Trade and Industry Ministers agreed to share examples of best practices and to develop together the health sectors' supplier industry with the aim of reducing costs. This will be done for instance by sharing costs and addressing the problem of fragmented demand through more uniformly expressed needs and closer cooperation. This cooperation experiment will last until the end of 2017.

3.5.2 Public procurement of innovative solutions

Reference is made to section 3.5.1 where the newly established tax incentive scheme is explained. As the system is newly established and is still undergoing changes no evaluation of the system is available yet.

3.6 Assessment

It is clear that total expenditure on R&D, which measured at up to 2.9% of GDP (in 2006) in during the pre-crisis, fell significantly in the aftermath years of the of the 2008 financial and banking crisis in Iceland. In 2013 and 2014, total expenditure measured at 1.87% and 1.89% of GDP, respectively (Statistics Iceland, September 2015). It is also clear that allocated funding in the 2015 budget and even more so in the 2016 budget will increase significantly total expenditure on R&D. In September 2016 it will be clear what the increase will be, but it is nonetheless clear that the envisaged 3% R&D expenditure rate is realistically not yet within reach.

In its coalition platform from May 2013, the Icelandic government emphasizes R&I innovation in all sectors but seems to put a particular focus on innovation-encouraging environment for the business sector as a premise for long-term growth. This focus on the business sector and start-ups is an apparent shift in policy from the previous government. Insufficient business enterprise expenditure on R&D has been for long pointed out to be one of the key weaknesses of the Icelandic R&D system but the focus of the government seems to be to make improvements in that regard. To attain this objective, the government has both increased the contribution for R&D in the 2015 and 2016 State Budgets, by offering tax incentives to private companies for R&D spending and to stimulate cluster strategies, or as stated by the Prime Minister in 2013: "…in order to create synergies between companies to undertake larger development tasks as well as to improve access of start-ups to equity capital (Icelandic Prime Minister's Office, May 2013).

Measures towards efficiency of available funds and for setting a more longer-term funding strategy was also seen in 2015. This has for long been pointed out by external reviewers as a weakness in the Icelanding R&I system. One of the main reasons for this criticism is to be found in the element of Iceland's parliamentary governance, namely that the multi-annual budget programming is not provided for in Iceland. The budget planning is done on an annual basis, usually introduced to the parliament in the autumn, to be approved in December for next fiscal year. Allocations for implementing multi-annual policies/programmes are reported in the annual budget bill as "binding agreements", although they need formal approval by the parliament through the adoption of the annual national budget. Multi-annual programming is practiced by certain government agencies and funds that allocate funding to projects of more than one year's duration (e.g. research and technology grants with up to seven years projects). This lack of connection between the stated government policy and how it is implemented through funding has for quite long been a matter of concern. In other

words, the policy of the STPC is not submitted to the parliament and approved there as a resolution of parliament. This has created a dire need for a longer term policy making with a clear and longer-term backing up of funds.

A new legislative proposal on public finances, called the Organic Budget Law, was passed in parliament in December 2015 with the aim of remedying this structural problem. The new legislation provides a framework for longer-term budgetary planning (five years instead of one) and addresses many of the shortcomings of short-term budgetary planning. The aim of the new legislation is to anchor annual budgets on medium-term objectives as well as to reduce total government debt. Also, consistent with the need for policy coordination, the law aims to make fiscal policy more predictable and less susceptible to adjustments during the budget year with the establishing of an independent fiscal oversight council, which assess the budget's adherence to the fiscal rules and medium-term objectives.

4. Quality of science base and priorities of the European Research Area

4.1 Quality of the science base

Iceland has one of the highest R&D intensities in Europe and has an excellent science base according to The Research and Innovation Performance in EU Member States and Associated countries 2014.

The 2014 Country Profile of the Innovation Policy Platform paints a similar picture as regards the general development in science, technology and innovation-base. The profile assesses Iceland to be a country diversified into knowledge services over the last decade, to complement its traditional resource-based sectors, particularly fishing and aluminium production. It highlights that the past years have also seen rapid growth in tourism.

A significant share of total R&D investment comes from the public sector, or 42% in 2011 which is higher than the EU average. The business sector accounted for 48% in 2011 and low business enterprise expenditure on R&D is one of the key weaknesses of the Icelandic research and innovation system.

In general Iceland scores low in new doctorate graduates although the most recent years have seen a steady increase in PhD studies (6% growth from 2013-2014). Part of the explanation is that many Icelanders take their doctorates abroad. It is also worth noting that because of very small population this figure will fluctuate between years.

Approximately 2% of the workforce has an engineering education in Iceland compared to an average of 4.5 % among other Nordic countries. The lack of labour supply in these areas is a barrier for growth in Icelandic companies. The percentage of population aged 30-34 that have completed tertiary education is considerably higher than the EU28 average, but the percentage of youth with upper secondary level education on the other hand is much lower.

When looking at the strengths and weaknesses of the Icelandic R&I system the following picture appears: Iceland scores highly in scientific co-publications, public expenditure, R&D, SME´s introducing products, process innovation, marketing and organisational innovations. It also scores high in business enterprise research and employment in knowledge-intensive activities. On the other hand it scores low on new doctoral graduates and community trademarks and community design. Iceland scores low in contribution of medium and high-tech products exports to the trade balance and sales of new to market and new to firm innovations. This should be seen in the light of Iceland´s resources based economy and the small size of the country (European Commission, 2014).

Iceland is a very knowledge-intensive country, with over 17,5% of employment in knowledge- intensive activities in 2012, compared with the EU average of 13.9 %. Iceland also measures at a high R&D intensity compared with other countries with a comparable industrial structure and knowledge capacity. In November 2015, Statistics Iceland published figures on R&D expenditures in Iceland for 2014, which amounted to 1.89% of the country's GDP, compared with the EU average of 2.03%. This is similar to expenditures of the UK, with 1.72% of GDP, and the Netherlands, with 1.97% of GDP (Statistics Iceland, 2015d)

A main challenge has been to transform this into economic competitiveness and competitiveness in high-tech and medium tech products and services. Iceland´s strong investment in R&D has triggered high scientific production and very good results in terms of participation in the EC Framework programmes. Another challenge is to increase the numbers of students participating in science, engineering and doctoral studies and there is limited expertise in technology transfer.

In the 2014-2016 STPC policy for science, some of the structural weaknesses mentioned above are being addressed (cross reference to chapters 2 and 6) that the main key assessment reports done in the past are already being addressed.

Table 3 Bibliometric indicators for Iceland

Indicator	Year	EU
Number of publications per thousand of population	3.73 (full counting) 2013	1.43 2013
Share of international co-publications	72.8% 2013	36.4% 2013
Number of international publications per thousand of population	2.71 2013	0.52 2013
Percentage of publications in the top 10% most cited publications	10.9 (fractional counting) 2010	13.31 2010
Share of public-private co-publications	2,7% 2011	1.85 2011

Source: RIO elaboration based on Scopus data.

4.2 Optimal transnational co-operation and competition

This sub-chapter deals with cooperation at EU level, including associated countries. Please note that any information on cooperation with third countries should be provided under "4.4 International cooperation with third countries"

4.2.1 Joint programming, research agendas and calls

Iceland is actively participating in one Joint Programming Initiative (*Oceans*) and in nine ERA NETS, as well as in the *EUROSTARS Article 185*. A new roadmap for Iceland's participation is being prepared and is expected to be published in 2016.

4.2.2 RI roadmaps and ESFRI

Iceland has participated in some of the preparatory phases of ESFRI infrastructures (such as CLARIN, ESSurvey, EPOS, LIFEWATCH, BBMRI, ECRIN, ELIXIR, ESSneutrons) and is a member of other international infrastructures. A Roadmap on development of the Research Infrastructures in Iceland was prepared in the spring of 2009 by a committee appointed by the STPC. The roadmap identified the most important and prosperous facilities in the Icelandic research community. The aim was to ensure that these would be supported so that the Icelandic science community would continue to prosper at international level. In December the same year (2009) the STPC accepted several of the committee´s proposals. However, the Roadmap itself was not formally adopted by STPC and financial commitments were not made.

Some of the roadmap's important objectives have nonetheless materialized. One important benefit from the roadmap was to ensure continued national access to electronic journals and databases with the complete understanding that such access is a critical part of infrastructure, needed to maintain high impact research and innovation activities in Iceland. Another point stressed in the roadmap, which has materialized was the importance of access to high-speed internet connections to international research networks in Europe and North-America. This has opened up opportunities for international cooperation in fields that rely on the methodology of electronic science and improved the potential for working with large quantities of information and data with computer networks, high-speed computers, diagnostic imaging, combined databases and net-based research instruments.

A new Roadmap on Iceland's participation in the programmes is currently being prepared. As of January 2016 it has not been made public.

4.3 International cooperation with third countries

Effective participation in international programmes is one of the policy goals of the STPC council's policy for the period 2013-2016 (Science and Technology Policy Council, 2015). The main focus is on the European Research Area and integration in the Nordic R&D programs. Iceland has also bilateral agreements with the United States and China. Priorities are geothermal energy, geology, marine biology, Arctic studies and medical research.

Iceland also participates in several other multilateral research programming, including NordForsk, which provides funding for Nordic research cooperation as well as advice and input on Nordic research policy.

There are no specific national programmes or initiatives for facilitating international co-operation of universities. Opportunities are opened up by multilateral or bilateral agreements and the institutions receive budget appropriations in order to make use of the opportunities created by the existing agreements. The legal framework for universities and colleges provides for their own initiatives in entering into international co-operation (Taxell et alia, 2009)

No special action has been taken to increase the attractiveness of Iceland as a destination for research. The devaluation of the Icelandic currency after the 2008 banking crisis as well as the Icelandic language may present a barrier to attractiveness for foreign researchers to seek employment in Iceland. The existing policy on the use of Icelandic as the official language of instruction and in academic writing presents significant challenges that will need to be resolved if Iceland aspires to attract more international students. A challenge for Iceland is to increase the numbers of students participating in science, engineering and doctoral studies. Technology transfer has for long been considered a challenge, but there has recently been an increase in expertise within the field of technology transfer through successful research and development active companies.

Rannis coordinates and promotes Icelandic participation in collaborative international projects in science and technology, including Horizon 2020.

Iceland ranks high in terms of applicant success the EU Framework Programmes, according to Innovation Union Competitiveness Report 2014. Administered by Rannis, there are three small grants available, aimed for supporting participation in research cooperation under Horizon 2020. These are "travel grants", for Icelandic participants to meet potential partners; "outreach grants" for Icelandic participants participating in project proposals; and "application grants" for Icelandic participants that apply as coordinators.

4.4 An open labour market for researchers

4.4.1 Introduction

According to the ERA-Synthesis Report from 2013, when defining the different types of governance of the researchers' labour market in terms of whether the career structure, is centrally determined or whether universities have a high- degree of independence (thus is more flexible), Iceland is placed with countries with a high degree of independence (see ERA-Synthesis Report 2013). In other words, Icelandic universities generally enjoy a high degree of freedom to set hiring and promotion conditions as well as career structures.

No actions have been taken to increase the number of students in study fields where there is lack of qualified staff, such as in applied sciences, in particular computer sciences. Except for the funds flowing from the competitive funds and the tax reduction scheme there is no other direct government support. After the 2008 crisis companies

were encouraged to hire from the unemployment registry and when researchers were on the registry it was possible to hire them to do research and get the equivalent of the unemployment benefits as a subsidy. As there are now so few researchers unemployed this is no longer an effective remedy.

4.4.2 Open, transparent and merit-based recruitment of researchers

Iceland is part of the European Economic Area (EEA) which includes free movement of people. Hence, EU citizens do not need work permits to enter the Icelandic labour market. Iceland is also part of the Schengen area. However, Iceland does not participate in the Scientific Visa Package arrangements for long term admission. All seven universities have signed up to the "European Charter for Researchers" and the "Code of conduct for the recruitment of researchers".1 The University of Reykjavík is a HRS4R Acknowledged Institution.

No formal barriers exist to recruiting non-nationals for permanent research and academic positions. Moreover, Icelandic research establishments and funding rules are traditionally open to researchers' mobility. A scheme for supporting incoming as well as outgoing researchers is within the remit of the Icelandic Research Fund. Iceland participates actively in the EURAXESS service network, which provides practical assistance to mobile researchers and their families. Rannis is a formal member of the EURAXESS network and is responsible for providing mobile researchers with information and access. On EURAXESS Iceland, foreign researchers can access information on vacant positions in Icelandic universities, research institutions and companies.

More informal barriers, such as e.g. the language barrier, relatively low salaries of academic staff and currency restrictions, are however likely to pose a challenge. Although English is widely spoken in Iceland and many courses are offered in English at universities, a holistic strategy or policy on the issue is missing. This is indeed one of the topics of concern pointed out by the external reviewers in the final report of the institution-wide review of the University of Iceland. The report draws attention to the existing policy on the use of Icelandic as the official language of instruction and academic writing, which is seen to present significant challenges that will need to be addressed with respect to graduate education and research (Rannis, April 2015). This should be a matter of concern for the higher educational institutions, in particular if they aspire to attract more international students and faculty.

There has been a general drop in permanent recruitment in the academia, especially since the financial crisis. Correspondingly, the average age of staff has been increasing. At the University of Iceland in 2013, the average age of faculty staff was 54 years, and the proportion of international academic faculty has been growing over the 21st century, reaching 15% in the case of the University of Iceland in 2011 (Rannis, April 2015).

Regarding internationalization of staff, a significant proportion of Icelandic staff studied, and, in many cases, worked at universities abroad prior to taking a position at the University of Iceland.

In addition to steep budget cuts to Icelandic higher educational institutions, the 2008 crisis increased unemployment in Iceland significantly, especially among university graduates. At the same time, there was a societal need for increased training and retraining opportunities in the aftermath of the 2008 crisis. The financial situation has also impacted the proportion of teaching carried out by part-time sessional teachers, and in some cases, up to 30% of all teaching is done by part-time sessional teachers

4.4.3 Access to and portability of grants

[1] The seven HEIs are: The Agricultural University of Iceland; Bifröst University; Hólar University College; Iceland Academy of the Arts; Reykjavík University, University of Akureyri; University of Iceland.

Competitive funds are in general open to foreign participation, including funding for foreign participants. The same funding rules apply for foreigners.

Funding is always allocated to Icelandic organisations or scholars/students with affiliation in Iceland. Generally, trans-border funding flows from national programmes is not allowed.

4.4.4 Doctoral training

One of the conclusions of the 2014 peer-review evaluation of Iceland's R&D system, the European Research and Innovation Area Committee (ERAC) was that although the opportunities for PhD students and young researchers have grown in recent years and while young researchers benefit from the high level of excellence in many research areas in Iceland, the organizational environment for PhD students and post-docs in Iceland is still underdeveloped (ERAC, 2014).

Due to the small size of the school system, Icelandic PhD candidates were until recently encouraged to pursue their doctoral studies abroad. This situation has however been changing quickly in recent years and in the last decade, Iceland has seen a rapid growth in the number of PhD programs offered by Icelandic universities.

Today, PhD studies are offered in a variety of disciplines, the significantly highest number of programmes however being offered at the University of Iceland. For every student enrolling in doctoral studies, there is a tenured advisor appointed for supervision, as well as special doctoral committee is assigned. The role of the committee is to monitor the progress of the study and ensure that it conforms to the planned course of study and research that was decided upon at the beginning of the study programme. The committee also has to ensure that the research work meets academic standards as prescribed in the rules of different Schools/Faculties as well as rules pertaining to doctoral studies at higher education institutions, issued pursuant to Article 7 of the Higher Education Act, (Act 63/2006) which give very detailed instructions on doctoral training.

All students with a master's degree who have been accepted at an Icelandic higher institution accredited for PhD training, or a similarly qualified HEI abroad, are eligible to some financial support from the Icelandic Student Loan Fund. The exact amount depends on their financial and personal situation and the place of their studies (if abroad) but for long it has been clear the amount that the Icelandic State Loan grants for PhD studies is far from being enough to cover the living expenses. Beyond the support of what the Icelandic State Loan provides, it is the responsibility of the PhD students to secure funding and there are only a limited number of scholarships available from private funding sources, the largest one being the Eimskip fund. This has lead to a systemic problem of drop-out amongst PhD students and the tendency to accept PhD students if they are financed by external project funding.

Despite funding of PhD studies being a challenge, Iceland has nonetheless seen a significant increase in the number of PhD students the past years, the latest figures showing an increase of 6% between 2013 and 2014. With the Bologna process and the subsequent progress towards shorter PhD studies, the ambition has also been to increase the quality of doctoral programs. New concepts have been developed for increased competitiveness, such as Centres of Excellence and "Graduate Schools". According to the latest available figures, the number of doctoral degrees attained were 93 persons in 2012, which per capita compares very similar to that of the other Nordic countries, with only Finland being exceptionally higher (Rannis, 2014).

As explained above, the current national R&I strategy of the Science and Technology Policy Council for 2014–2016 was complemented by a 21-point Action Plan in 2014, specifying clear objectives, deliverables, responsible parties. Already in the fall of 2014, the State Budget for 2015, as a part of the ISK 800 million (€ 5,6 m) increase, saw a specifically earmarked increase in contribution to increased funding of PhD studies.

Another process that was started in the spring of 2015 was the formation of a committee mandated to draft amendments to the framework legislation for research institutes. The committee's mandate is to produce concrete proposals by 2016 to reduce fragmentation in the system and to increase collaboration between institutions. The goal is also set to simplify and merge existing legal frameworks of research institutes as to better coordinate their activities and functions. The committee has started its work but has not made any concrete actions public as of January 2016.

4.4.5 Gender equality and gender mainstreaming in research

Iceland is among the leading countries in its efforts to achieve gender balance in society, including research, through different measures such as legislation, action plans and programs. All EU directives concerning gender equality have been implemented in Iceland.

In 2014, Iceland was rated number one on the Global Gender Gap Index, with a score of 0.8594, where the highest possible score is 1 and the lowest possible score is 0 (inequality). Iceland has held first place in the ranking since 2008. Among the variables where Iceland is ranked with the score of 1 on the female-to-male ratio are: professional and technical workers, enrolment in tertiary education, and political empowerment (World Economic Forum, 2014).

According to the law on gender equality (Act 10/2008), gender mainstreaming is required in all government policies and in decision making. The Act stipulates that equal participation of women and men shall be promoted in committees, boards and councils under the auspices of the Government. Consequently, this applies in HEIs and all bodies within the field of science. In 2008 the law was amended and an article on gender quotas was included. This article (article 15) stipulates that when designating members for governmental or municipal committees, councils and boards, the ratio of women to men needs to be as equal as possible. Where the number of members exceeds three, the percentage must not be below 40% of either gender.

In 2013, changes to the law on public limited companies (Act 2/1995) and private limited companies took effect, obliging companies with more than 50 employees to have both women and men on their company boards. These amendments also included provisions to facilitate monitoring.

The majority of students enrolled in Iceland's universities in Iceland are women. The male-female ratio at the University of Iceland in 2015 stood at 34-66.

All the HEIs employ Gender Equality Advisors, although in some of the smaller institutions, this role may be a role carried out by someone with other duties. All the universities have their own Gender Equality action plan. The proportion of women participating in R&D has been growing in all sectors and types of institutions. Figures on the percentage of total R&D personnel (FTE) in Iceland show that in 2014, men performed 62% and women performed 39% of work done in R&D (World Economic Forum, 2014).

In 2014, 56% of PhD graduates were men and 44% woman, compared to 53% men and 47% women in 2011. This ratio fluctuates between years, as Iceland's population is very small. In 2009 for instance, women were 60% of the PhD graduates. Access to day care has been emphasized as a key factor in ensuring gender equality in the labour market, and the vast majority of pre-school children attend kindergarten.

Increased seniority in research for females is still a problem in Iceland. While there is no lack of female researchers in Iceland, their advancement and seniority (for instance towards full professorship) is still too slow. The last 15 year has seen significant development in the right direction, but the figures still present inequality in the highest academic positions. At University of Iceland in 2015 the proportion of female professors was only 29%, whereas the proportion of female associate professors (i. dósent) is 56%

(University of Iceland; employee statistics; http://www.hi.is/adalvefur/starfsmenn, latest update January 2016).

The gap in remuneration between women and men researchers in Iceland is around 10%.

The research funding agencies are gender-neutral in their selection criteria. Similarly, research funders do not pose any gender-equality-related conditions in their grants.

4.5 Optimal circulation and Open Access to scientific knowledge

4.5.1 e-Infrastructures and researchers electronic identity

A working group on research infrastructure was established in 2014. The working group's main task was to address questions regarding e-infrastructures through regular monitoring and to write recommendations for the STPC council. The working group finished its work in December 2015 and publication of the working group's recommendation is foreseen in March 2016.

4.5.2 Open Access to publications and data

In general, open access to databases and electronic journals has been high on the agenda of Icelandic policy makers. In 2012, the Berlin Declaration was implemented into Iceland's R&I framework legislation ("Act on Public Support for Scientific Research"), where it was stipulated that research findings, funded through the funds governed by these laws, shall be available in open access unless other exceptions have been agreed upon. In January 2013 Rannis, in accordance with the new law, included a clause in all contracts with grantees which states that scientific publications based on projects, funded entirely or partially by Rannis must be published in Open Access. Still, the mandate extends only to peer-reviewed articles and not to other scientific publications, results or research data, and not to projects that have received grants from Rannis prior to January 2013, even though Rannis encourages all researchers to publish in Open Access.

In January 2016, Rannis published, for the first time, a Handbook for Applicants, Expert panels and External Reviewers applying for The Icelandic Research Fund (IRF), with the objective of increasing transparency of the process for all parties involved and to increase access to all the applicable rules and procedures (Rannís, 2016). In the handbook, the framework legislation (the Act on Public Support for Scientific Research no. 3/2003 with later amendments) as well as the IRF's funding rules and procedures are explained in a precise and reader-friendly manner, including the fund's rules on open access. As stated in the guidelines, "unless otherwise agreed upon, researchers who receive funding from IRF must guarantee that their research findings will be available through open access. Researchers may either publish in journals with an open access practice, or in open searchable, digital repositories along with the publication in a traditional subscription journal". As described in the 2016 guidelines of Rannís to the IRF beneficiaries, the final peer reviewed manuscript shall be returned to the repository immediately after the article has been accepted for publication. The guidelines state furthermore; "…if the journal demands a waiting period prior to open access, the grantee shall upon submission of manuscript to repository specify that the the article shall be made available for public access automatically when the waiting period expires" (Rannís, 2016).

There are open repositories maintained by Landspitali University Hospital and the National and University Library.

The Iceland Consortia for electronic subscriptions, hosted by the National and University library, serves not only academics and research institutions, but each and every computer in the country that is connected to the Internet through an Icelandic Internet Service Provider (ISP). This gives access to 8,000 journals in full-text, 2,000 journals in

A&I and 12 databases anywhere in Iceland, around the clock, regardless of location or affiliation. The agreement with the publishers also includes electronic subscriptions to journals that are not included at a reduced cost to national libraries.

In the 2016 State Budget, approved in parliament in December 2015, around € 0.5 m (ISK 70 million) was allocated for purchasing a new comprehensive *national synchronized repository system* (CRIS system). When operational, although not before end of 2017, the new comprehensive repository system will replace the systems currently used by the National University Hospital and the National University Library.

In January 2016, tender preparations are being made, with hope of implementation of the system to be completed by the end of 2016. When operational, the system will provide a principal overview of research and innovation activities in Iceland, to improve statistics and facilitate assessments to be made of the activity and of the quality of research carried out in Iceland's HEIs and research institutions. The information system will also be able to provide information about the use of human resources, teaching activities and the level of finance received from research funds in Iceland.

For research institutions and policy makers, the system is envisaged to respond to the need for documentation of research results as well as to serve as a basis for analysis. It will facilitate knowledge about research ethics and provide a foundation for increased confidence in research, e.g. through increased visibility and dissemination of results.

For researchers, it is expected that the new system will save time by simplifying application procedures and reporting tasks. It will also respond to the need for visibility and attractiveness related to own activities and expertise.

For the media and the general public, the system is expected to provide easier access to information and respond to the need of the media for an overview of Iceland's competence profile and to highlight research in the media and in society in general.

A recent analysis by an Icelandic expert in this field concludes that Iceland's rating towards Open Access in research articles in terms of Gold, Green or hybrid is approximately 30%. For Landspitali University Hospital, the total rating is approximately 40%. Golden or hybrid open access applies to research articles accessible right after publication but green open access mostly after 6 – 12 months' embargo (Thorsteinsdottir, Solveig, 2014).

Another study from 2013: "The Icelandic Open Access Barometer 2013" reviewed all of Iceland's academic and or scientific journals and found that out of Iceland's 51 journals, 16 were completely open, with articles available for digital download from the moment of publication; 20 were published only on paper and sold to libraries and subscribers; and the remaining 15 released their articles openly in digital form after an embargo period of varying length. The conclusion was that the the majority of Icelandic journals offer open or delayed access on a gratis basis, but very few of them actively market themselves as "open" to current or potential readers (Watson I and Thorisson G, 2013).

5. Framework conditions for R&I and Science-Business cooperation

5.1 General policy environment for business

According to The World Bank Doing Business Rating for Iceland in 2015, benchmarked for June 2014 in the group of advanced economies, Iceland ranks 12 on the ease of doing business, above Germany, France and average of OECD, but below the other Nordic countries, Denmark, Sweden, Finland and Norway (The World Bank, 2014). Globally, Iceland stands at 31 in the ranking of 189 economies on the ease of starting a business according to the same rating of the World Bank. One of the progress mentioned for Iceland in 2015 was that Iceland made starting a business easier by offering faster online procedures.

5.2 Young innovative companies and start-ups

The Innovation Center Iceland runs several innovation and start-up incubator centers for entrepreneurs. The aim of the incubator centers is to provide entrepreneurs with facilities, a creative environment and professional advice in order to work on innovation, as well as the potential of developing a strong and powerful network of contacts with important parties in business and with other entrepreneurs who are going through the same process. The centers offer rental of office premises, access to meeting rooms and other facilities for research and prototyping. They offer professional advice and support in form of contacts and more. The project focuses on health, education, and energy and environmental issues.

Clusters have become an important part of Iceland's policy. The Iceland 2020 Policy Statement highlights the need for a cluster policy and actions. The policy states that the formation of business clusters will be supported in fields where there are opportunities for responsible growth, in particular "for the creation and support of cooperation clusters in the fields of energy and geothermal power as well as between the fishing and food industries" (Icelandic Prime Minister's Office, 2011).

As regards training and collaboration between academy and business, in February 2015, agreements named: "Samningar um sóknaráætlanir 2015-2019" were made with the eight regional associations of local authorities for a five year strategic plan. Through the means of theese agreements and accompanied funding, competitive funding-support was provided for the strengthening of entrepreneurship where priority will be given to cluster collaboration and tripartite collaboration between companies, knowledge-based institutions, and the public sector.

In recent years, several new clusters have been formed. A strong maritime cluster has been up and running since 2012 and plans are advanced regarding the establishment of a tourism cluster, food production cluster and a design cluster.

In the explanatory chapters of the State budget for 2016, the government takes careful note of the very recent changes of the framework guidelines for state aid for research and development and innovation, which includes the possibility for increased state support for clusters as well as for young innovation companies and start-ups. These guidelines entered into force in the EU on 1 July 2015 and were incorporated into the EEA Agreement by the decision of the EEA Joint Committee shortly after and published in the EEA Supplement to the Official Journal of the European Union on 6 August 2015

5.3 Entrepreneurship skills and STEM policy

There is lack of qualified staff in Iceland in engineering and applied sciences, in particular computer sciences. Iceland has been an active participant in the EU's Researchers nights.

The GERT initiative (Enhancing Education in the Natural Sciences and Technology) started in 2012 as a public-private partnership involving the government, municipalities and industry federations. The aim was get young people interested in natural sciences and engineering where there is lack of qualified staff, such as in applied sciences, in particular computer sciences. A new policy paper on reform of the Icelandic school system is one of the goals of the STPC. It is expected that the policy paper will address this issue as well as of the restructuring of higher education in Iceland in general.

Entrepreneurship teaching in Iceland's universities and other HEI are both common and popular but there are no existing measures in Iceland aiming to support staff training in young SME'.

5.4 Access to finance

The effects of the financial and banking crisis have strongly been felt in reduced options and reduced access to finance. Apart from the strain that the banking crisis had on Icelandic companies in terms of access to finance, the implementation of capital controls to prevent capital flight following the banking collapse in 2008 reduced access to finance significantly. Although these controls are partially still in place, major steps to remove them have been taken in October 2015, plans to remove them in full in the near term were made public. Until they are fully removed, this nonetheless creates difficulties for growing companies, as capital controls tend to reduce the supply of capital and raise the cost of financing, especially in the longer term. This poses a particular challenge for a small economy such as Iceland, which does not have access to international capital markets or the backing of the European Central Bank.

In the period 2012-2015, Iceland has experienced many seed ventures and start-ups moving abroad in order to secure venture capital.

Today it is difficult for pension funds to find domestic investment opportunities and the currency controls make it impossible to invest abroad. Legislation is being prepared that will make it possible for pension funds to invest in unlisted companies, and it is anticipated that pension funds will invest considerable funds in them following the changes.

The loans available are very expensive, as interest rates in Iceland are quite high compared to other European countries. It is not uncommon for banks to offer credit with 9% interest rates and for indexed loans 6%. It is also a problem that start-ups and innovation companies often lack the collateral required when applying for loans with Icelandic banks.

The number of funds that invest in start-ups and innovation companies is limited. The leading one is NSA Ventures or (i.Nýsköpunarsjóður atvinnulífsins), a state-owned venture capital fund, although financially independent (no state financial contributions). The fund has since its establishment in 1998 invested in close to 150 companies. The fund has a strategic focus on investments in technology and the life sciences.

A new fund "Frumtak 2" was established in February 2015 to replace the earlier "Frumtak" fund. The fund invests in early-stage, post-seed innovative companies that show great potential for growth. The fund invests primarily in Iceland, but is allowed to invest abroad as allowed by law in connection with its portfolio investments to ensure success in foreign markets. The fund does not specialize in any particular industry, but emphasizes investment in companies whose primary objective is growth and sales in foreign markets. The aim of the fund is to ensure that original ideas get a chance and thereby increase the probability of creating growth and value.

5.5 R&D related FDI

Policies aimed at attracting R&D intensive FDI have been on hold in Iceland since the 2008 banking crisis and the introduction of currency restrictions. Reference is made to chapter 5.4.

5.6 Knowledge markets

Intellectual property rights and the protection of intellectual property are substantially dependent on international co-operation. Iceland is party to a number of international agreements in this field. The principal international bodies in the field of intellectual property rights of which Iceland is a member:

World Intellectual Property Organisation

The European Patent Office

The Nordic Patent Institute

In addition to this Iceland has implemented all the directives of the EU in the field of intellectual property rights to avoid these issues to be a barrier for researchers

5.7 Public-private cooperation and knowledge transfer

Knowledge transfer between the academia and applied sciences is actively being promoted by the Research Liaison Office of the University of Iceland, whereas the Innovation Center Iceland operates with the intention of strengthening knowledge and technology transfer to and within Icelandic businesses and industries.

Also, since 2009, the Strategic Research Programme for Centres of Excellence and Research Clusters, hosted by Rannis, has emphasized the collaboration of higher education institutions, public research institutes and businesses. Grants have been allocated to three cooperation clusters focusing on geothermal energy, artificial intelligence, and diversity studies. The funding period runs for seven-year periods, the next starting in 2016. Funding for the next period has been secured and application procedures are taking place in early 2016.

5.8 Regulation and innovation

The Ministry of Education, Science and Culture appointed in 2014 a Working Group on Research Infrastructure. The working group was formed in 2015 and finished its work in December. One of the tasks of the group was to address the question of open access to data gathered through regular monitoring and research in public research institutions. Another task was to map out which projects require long-term funding. The group will deliver a report in the autumn of 2016, containing proposals on (a) how to decide on the order of priority of supervision projects; (b) ways to ensure that Iceland meets its international supervision obligations; (c) whether a more cost-efficient arrangement for supervision can be found; (d) ways to secure more funding for long-term supervision projects. An intermediate report is scheduled to be submitted to the Science Board and the Technology Board of the Science and Technology Policy Council in the spring of 2016.

5.9 Assessment of the framework conditions for business R&I5

The policy measures announced in 2015, with focus on improving conditions for business R&D include envisaged support for innovation companies through tax deduction, envisaged changes to the VAT system in 2016, the establishment of a new venture fund, incentives for initial investment and digitalisation of the a new business register. Various ministerial working groups have been commenced and as of March 2016 it is envisaged that concrete plans and measures will be made public.

6. Conclusions

6.1 Structural challenges of the national R&I system

There are four main challenges that the key evaluation reports, namely the 2014 ERAC report and the 2009 Taxell report, have highlighted when examining the Icelandic R&I landscape:

1. **Firstly, the problem of discrepancies between the stated government policy and how the policy is not always followed through in annual budget allocations.**

This is regarded to be a structural problem. The Icelandic R&I system is centralized in the sense that the is set by the Science and Technology Policy Council (STPC), headed by the prime minister and involves all responsible ministries. The the ministers make R&I funding proposals to the parliament, for the annual government budget preparations. As the the policy of the STPC is not submitted to the parliament and approved by it as a resolution, a structural problem occurs, namely the one of discrepancies between the stated government policy and how the policy is followed through in terms of budgetary allocations.

This is becomes a particular problem for policies such as R&I policy that needs long term planning, in particular with regard to long term R&D goal setting (such as 4% R&D intensity by 2020).

There is a lack of access to venture capital in the form of equity and loans, the price of loans are Iceland in comparative terms and the currency restrictions have been a major hindrance to investments and growth of Icelandic companies.

2. **Secondly, the large number of Universities and research institutions, when viewed in terms of the total population that there is a large number of universities and research institutions.**

There are seven universities and 14 main research institutions. In addition to these there are a number of knowledge centres. It has been pointed out, numerous of times, that the main weaknesses of Iceland's Higher Educational Institutions are their small size and lack of financial resources compared to EU28 but even more so to the Nordic countries. Iceland spent 1.2% of GDP on tertiary education in 2012, which is similar to Germany but significantly lower than Denmark, Sweden or Finland (OECD 2016).

3. **A third weakness in the system is that larger proportion of total funding of R&D should go through competitive funding instead of block funding.**

The number of applications to the Icelandic Research Fund were 266 in 2012. The same year number of grants was 47, or 18% of applications. The proportion was similar in 2010. A rough estimate indicates that a third to 40% of the applications are of a high enough quality to deserve grants but the fund available are only enough to grant about 60% of the applications that are thought to be of sufficient quality. In addition to this the grants that are given are not high enough, resulting sometimes in Icelandic scientists having to go abroad if they want to dedicate themselves to the research in the field of their expertise.

4. **Finally, it seems clear that performance-evaluations need to have more impact on the allocation of R&D funds.**

Around 80% of public funds for research go directly to institutions without any kind of impartial evaluation of the work being done. The applications that are given grants from the competitive funds are of course evaluated but a comprehensive evaluation of the R&D system has not been carried out in the last few years. There is a need to increase cooperation between universities, research institutions and companies with the goal of getting better outcomes and increasing efficiencies. The talent pool available for research need to be made larger by strengthening doctoral studies, studies in science

and engineering, shortening the time that it takes it get a university degree and increase the cooperation of private industry, research industries and the educational system. The quality and outcomes of research and innovation should be measured and the measurements should be used as a part of cycle of continuous improvement

6.2 Meeting structural challenges

Firstly, the passing of the Organic Budgeting Law in December 2015 is a positive step in the direction of providing a better base for long term budgetary planning in the field of R&I and creating more stability for those working in the field of R&D. It should also be highlighted that the passing of the 2016 State Budget in December 2015, with significant increases to R&D reflects a strong commitment of the government to meeting those structural challenges. So do the proposed changes to the tax system.

In 2014, on the basis of the 21-point Action Plan, an increase of ISK 800 million (€ 5,6 m) was provided in the 2015 State Budget, allocated for public competitive funding. An even higher increase of close to ISK 2 bn (€ 14 m) is allocated to the 2016 State Budget, out of which € 6.4 m will be devoted to the Icelandic Research Fund and € 6.8 m to the Technology Fund (Source: Draft State Budget 2016, p.35-37). THis in effect translates into close to a doubling of the size of these two funds from 2014 to 2016. What remains a challenge when meeting the envisaged 3% in R&D expenditures before end of 2016 is the missing increase in private investments.

Secondly, on the issue of fragmentation of the system, the current minister for education has highlighted his vision to change the system and make it more efficient. In the new STCP policy it is recommended that the framework for science and innovation in Iceland should be simplified, integrated, and where appropriate give opportunities to integrate universities and research institutions. As government finances are getting better, more funds can be made available and at the same time the government will be able to tie the increased funding to more cooperation between the universities.

Work has started towards creating a five year strategy (until year 2019) for the higher education institutions, with the goal of increasing excellence, efficiency, quality and collaboration in the system. One interim report was published in October 2015 but the strategy is expected to be finalized in 2016.

Another process that was started in the spring of 2015 was the formation of a committee mandated to draft amendments to the framework legislation for research institutes. The committee's mandate is to produce concrete proposals by 2016 to reduce fragmentation in the system and to increase collaboration and efficiency of the R&I policy actors, but also to simplify and merge existing legal frameworks of research institutes as to better coordinate their activities and functions. The committee has started its work but has not made any concrete actions public, at the time of the writing of this report in January 2016. A part of the ISK 800 million (€ 5,6 m) increase in the 2015 State Budget was earmarked for strengthening the PhD education in Iceland. The aim is that by end of 2016, 200 PhD positions will be fully financed by the national competitive funds.

Thirdly on the issue of competitive funding, the new policy of the STPC for 2013-2016 calls for competitive funding for universities and research institutions to be increased so that it will be about a third (instead of 20%) in the near future. Important steps were taken in 2014 and 2015 towards increased evidence-based policy making, for instance with a € 70,000 increase from 2012 levels Statistics Iceland in 2014 and 2015, to underpin new responsibilities for gathering and processing data on research and development expenditures and on innovation levels.

Finally, on the topic of quality of research and correlation to funding, some positive steps were taken in 2015 and 2016 with a total of 70 million ISK being invested in a comprehensive research and innovation information system (CRIS-system), to be implemented in all seven HEIs, research institutions, the Landsspítali University Hospital and the National Library. The system will provide an overview of the research and

innovation activities of the participating institutions, allowing for better analysis of the quality and impact of research and innovation. Moreover, it will provide the Icelandic authorities as well as the management of the institutions detailed information for decision making and the setting of strategies and policy goals.

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Annex 2 - Abbreviations

AVS – e. AVS R&D Fund of Ministry of Fisheries and Agriculture in Iceland – i Rannsókarsjóður í sjávarútvegi

EEA – e. European Economic Area – i. Evrópska efnahagssvæðið

EU – e. European Union – i. Evrópusambandið

GBAORD – e. Government Budget Appropriations or Outlays on R&D -

GDP – e. Gross National Product – i. Verg landsframleiðsla

SME – e. Small and Medium Enterprises – i. Lítil og meðalstór fyrirtæki

ISK - Icelandic króna - Íslenskar krónur

OECD – e. Organisation for Economic Co-operation and Development- i. Efnahags- og framfarastofnunin

R&I – e. Research and Innovation – i. Rannsóknir og þróun

Rannis – e. Iceland Centre for Research – i. Rannsóknamiðstöð Íslands

Annex 3-List of Tables

Annex 4 – List of the main research performers

University of Iceland and Landspítali University Hospital are Iceland's academic/public R&D performers
Five companies are the the largest contributors to private R&D investment in Iceland, namely:

- Actavis,
- CCP
- Decode Genetics
- Össur
- Marel - Out of top five private research performers, Marel is the only one to be ranked on the 2014 EU Industrial R&D Investment Scoreboard, which contains economic and financial data for the world's top 2500 companies. Marel ranked at 1120 with investments in research and development efforts in 2014 measuring at € 53.7 m.

Annex 5 - List of the main funding programmes

Name of the funding programme	Timeline	Budget	Target group
The Icelandic Research Fund	Ongoing - No end date planned		Researchers in research studies at universities, research institutes and companies. Objectives The IRF awards funding to research students and defined research projects led by individuals, research teams, universities, research institutes, and companies.
The Technology Fund	Ongoing - Ongoing - No end date planned although the rules of the fund are undergoing review (October 2015)		Individuals, universities, business enterprises and public institutions. The role of the fund is to support research and development activities, which aim towards innovation in Icelandic industry. The Technology Development Fund is a competitive fund
The Infrastructure Fund	Ongoing - Ongoing - No end date planned		Research institutions and companies. Purpose is to o support research infrastructure in Iceland by co-financing purchase of equipment, databases, software and any other research infrastructure that is important for scientific progress.
The Agricultural Productivity Fund (i. Framleiðnisjóðir Landbúnaðarins)	Ongoing, end date 2017.		Supports technical innovation in farming. Administered through the Icelandic Farmer's Association through a contract with the State.
The Strategic Research Programme	Ongoing		Researchers and students in research studies at universities, research institutes and companies. The IRF awards funding to research students and defined research

			projects led by individuals, research teams, universities, research institutes, and companies.
The Student Innovation Fund	Ongoing - Ongoing - No end date planned		SMEs and university students. Aimed at SME's who can benefit from hiring graduate students for a summer term, to enhance research and technology transfer.
Icelandic Language Technology Fund			Individuals, organizations, institutions, and others interested in enhancing Icelandic language technology. Funds are available for projects broadly related to developing Icelandic Language Technology in digital form.
The Non-Fiction Writers' Fund	Ongoing - No end date planned		Independent scholars. General non-fiction work, reference books, dictionaries and extensive information material in Icelandic in various forms
Energy Research Fund (partly state funded)	Ongoing		Promotes research within energy and the environment Allocations are divided into three categories: grants for masters' degrees or PhD's, researching environmental and energy issues, general research
AVS R&D Fund of Ministry of Fisheries in Iceland – "the AVS fund"	Ongoing		All companies Higher educations institutions research units/centres Other non-profit research organisations (not HEI) Technology and innovation centres (non-profit)

Tax Credit Scheme	Ongoing	Parliamentary proposal will be submitted in spring 2016	Enterprises that carry out research and development projects. Purpose is to strengthen research and development activity and improve the competitive condition of innovation.
Energy fund of the National Energy Authority (Orkustofnun)	Ongoing		Grants loans to companies, municipalities and private initiatives to increase the use of geothermal resources,

Annex 6 - Evaluations, consultations, foresight exercises

1) "The Taxell report" a comprehensive evaluation of the Icelandic R&I system, conducted on 2009, see:
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